

SAN FRANCISCO INTERNATIONAL AIRPORT RUNWAY RECONFIGURATION PROJECT

**POTENTIAL FUTURE CONTRIBUTION  
OF AIR TRAFFIC MANAGEMENT TECHNOLOGY TO  
THE CAPACITY OF SAN FRANCISCO INTERNATIONAL AIRPORT**

Report of the Independent Technology Panel

Prepared for

San Francisco International Airport  
San Francisco Bay Conservation and Development Commission

August 2001

**Summary**

In order to ensure that appropriate air traffic management technologies are considered in the environmental review process for the Runway Reconfiguration Project for San Francisco International Airport (SFO), the Airport and the San Francisco Bay Conservation and Development Commission (BCDC) agreed to form an Independent Technology Panel to identify viable technological capacity enhancements that may meet or approach the purpose and need of the project, and to provide an independent assessment of the potential impact of new technologies on the capacity of SFO. The Technology Panel was asked to evaluate the viability of potential improvements in air traffic control technology, airspace allocation, and aircraft navigation, surveillance, or communications technologies and the extent to which, alone or in combination with other measures, they may increase the capacity of SFO to address two of the project needs:

1. Reduce existing and projected flight delays
2. Accommodate projected flight demand.

It was agreed that the Technology Panel would focus on potential technologies to improve airfield capacity and/or reduce delays at SFO, and would recommend a suite of viable technological capacity enhancements to be included in the project alternatives (both build and no-build), as applicable. These recommendations would take into consideration the availability of technologies and their potential cumulative benefits to improve capacity or reduce delays at SFO.

The Panel members consisted of Capt. William B. Cotton of Cotton Aviation Enterprises, Inc., Mount Prospect, Illinois, John Foggia of Aviation, Navigation, and Satellite Programs, Inc., Chicago, Illinois, and Dr. Geoffrey D. Gosling of the University of California at Berkeley.

## **Issues to be Considered in Addressing the Potential Role of Technology**

The Panel gave particular attention to a number of important issues that need to be taken into account in any consideration of the potential role of future air traffic management technologies in enhancing the capacity of SFO. The first issue is the operational constraints that arise from the existing runway layout and the operational configurations that are required to be operated in various weather conditions. The Panel recognizes that any significant reduction in air traffic delays with the existing runway configuration will require the ability to operate arrival traffic to two closely spaced parallel runways under instrument flight conditions. This is currently not possible with existing instrument landing and air traffic control technology. In addition, the need to provide gaps in the arrival stream to release departures on crossing runways means that arriving aircraft will need to be paired close together, as they are currently under visual flight conditions.

The Panel also considered a number of other issues that will affect the potential contribution of new technologies, including the time required to meet the certification and approval requirements, as well as install any necessary equipment on the aircraft fleet and train the flight crews in the new procedures, the need to obtain stakeholder buy-in, and the uncertainties that result from the complex interaction of all these factors.

## **Review of Previous Studies**

The panel reviewed several previous studies that had been prepared for SFO, BCDC and others and that addressed the potential role of future air traffic management technologies at SFO, as well as a number of other relevant studies, including recent Federal Aviation Administration plans for the future evolution of the National Airspace System. While these studies identified most of the potential future air traffic management technologies that the Panel believes are applicable to SFO, the Panel found that the studies performed to date do not provide an adequate quantitative basis for assessing the future impact of these technologies on capacity and delays at SFO, and fail to clearly distinguish between the **operational capabilities** that will provide increased capacity and the **enabling technologies** that are required to implement these operational capabilities. In addition, many of the previous studies considered the various technologies in isolation and did not address how they could be combined to provide future operational capabilities that would enhance the capacity of SFO.

## **Conclusions and Recommendations**

The Panel was asked to evaluate the prospects for air traffic management technology, airspace allocation, and aircraft navigation, control or communication technologies that could increase the capacity of SFO to reduce existing and projected flight delays and accommodate projected flight demand. The panel believes that technology related operational capabilities alone will not eliminate all existing and projected flight delays or fully accommodate long-term projected flight demand.

The Panel has identified a number of future air traffic management technologies that will enable operational capabilities that can increase the arrival capacity of SFO during poor weather conditions, and recommends that the following operational capabilities and their associated

enabling technologies be considered in the environmental review process:

- Precision Runway Monitor with a Simultaneous Offset Instrument Approach procedure
- Required Navigational Performance
- Paired Approach procedure based on the use of Automatic Dependent Surveillance – Broadcast (ADS-B) for aircraft separation
- Wake Vortex Advisory System
- Use of Center TRACON Automation System tools and ADS-B to increase the arrival capacity of a single runway.

These operational capabilities vary with respect to both the likely capacity increase that they can provide and the timing when they are likely to be available. Those operational capabilities that will become available between now and 2005 appear likely to offer only modest increases in capacity with the existing runway configuration. As additional operational capabilities become available further in the future, they will enable larger increases in capacity. Furthermore, with several of these technologies, the increase in capacity that they provide depends on the extent to which aircraft are equipped to take advantage of them and flight crews are trained in and able to fly the necessary procedures. Therefore the capacity increase that they provide will initially be fairly small, and will increase over time as more aircraft are equipped and flight crews able to take advantage of the procedures.

Even so, it does not appear that the operational capabilities that will become available between now and 2010 will close the gap between the good weather and poor weather capacity. At best, it appears that by 2010 the arrival capacity of the existing runway configuration might be increased to about 45 aircraft per hour from the current 30 aircraft per hour. However, this will only be possible for some poor weather conditions. For other weather conditions, the increase will be much less. More advanced operational capabilities that could become available in the 2010 to 2015 time frame offer the potential to further increase the poor weather arrival capacity of the existing runway configuration under a wider range of poor weather conditions. By 2015, it may be possible to achieve an arrival rate to closely spaced parallel runways of as many as 60 aircraft per hour under most poor weather conditions.

The operational capabilities and their associated enabling technologies that the Panel recommends be included in the environmental review of the Runway Reconfiguration Project differ for the No-Build and Build Alternatives. This distinction is not completely clean, since two Build Alternatives retain the closely spaced parallel runways in the north/south direction. Since arrivals on the Runway 19 pair during Southeast Plan operations only occur a small percentage of the time, consideration should be given to whether the costs of implementing an operational capability that allows simultaneous instrument arrivals to both Runway 19L and 19R for Alternatives A-3 or BX-2 are justified by the delay reduction benefits. This cannot be determined without a much more detailed analysis than has been performed to date or the Panel had the time or resources to undertake.

The capacity benefits from any given set of technologies depends on both the traffic characteristics at the time and the extent to which the aircraft fleet is equipped to take advantage of them and the flight crews are trained in and comfortable with the necessary procedures.

Therefore an adequate assessment of the likely increase in capacity from any particular set of operational capabilities in some future year will require a much more detailed analysis than the Panel has had either the time or the resources to perform. In order that the potential contribution of future air traffic management technologies can be properly addressed in the environmental review process, a quantitative assessment of both the likely capacity benefits of the various operational capabilities identified by the Panel and the associated uncertainties will need to be made. This assessment could be undertaken in parallel with other parts of the process and will need to consider the operational context within which the various technologies might be deployed as well as the extent to which the various technologies complement each other.

The Panel believes that SFO is in a strong position to take an active leadership role in the deployment of new air traffic management technologies, and that such actions will make a big difference in how quickly potential future capabilities become available. The Panel recommends that SFO formally engage in a strategic technology initiative to accelerate the deployment of new air traffic management technologies. This would build on its current efforts to deploy PRM/SOIA and could be coordinated with similar efforts by other airport authorities.